

6 Eco-friendly technologies for smallholder agriculture

The Cassava-Harvesting tool

James T.J, Sharad Rai, Chesha Wettasinha, Ann Waters-Bayer, Stebin K, and Hubby Mathew

Smallholder farmers often face severe drudgery and environmental challenges in crop production. Cassava, an important crop in Kerala, India, is traditionally harvested by hand, which is labour-intensive, physically demanding and ecologically unsustainable. Two farmer brothers developed a cassava-harvesting tool that reduces drudgery, minimises soil erosion, and promotes eco-friendly agriculture. Supported by the Prolinnova network, the innovation is now spreading across India and has attracted international attention.

9 'Prabodhan Agriculture Implements Bank An innovative experiment in agriculture mechanisation

Suresh Margale

Access to appropriate farm implements enhances productivity, while addressing labour shortage issue. The Agriculture Implements Bank initiative shows how farm equipment could be made easily accessible while generating enough revenues and gainfully engaging youth in agriculture in rural areas.

16 Building innovation adoption capacity of rural communities

S Sai Mohan, Asmita Moon, M Chandrasekhara Rao and Ravindra Adusumilli

Sustainable mechanization for smallholders is not merely about machines—it is about building local capacity, enterprise and trust. Innovation Guild's ecosystem model shows that with the right partnerships, technology can truly take root in rural India.



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Ashutosh Pal and Amar Kumar Gouda

Small farmers often have limited access to farm machines owing to high costs. A sustainable mechanization model that enhances productivity while ensuring environmental, social and economic balance is therefore necessary. Mahashakthi Foundation's sustainable farm mechanization initiative has succeeded in providing access to farm machinery, while reducing the drudgery.

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Eco-friendly technologies for smallholder agriculture

The Cassava-Harvesting tool

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Smallholder farmers often face severe drudgery and environmental challenges in crop production. Cassava, an important crop in Kerala, India, is traditionally harvested by hand, which is labour-intensive, physically demanding and ecologically unsustainable. Two farmer brothers developed a cassava-harvesting tool that reduces drudgery, minimises soil erosion, and promotes eco-friendly agriculture. Supported by the Prolinnova network, the innovation is now spreading across India and has attracted international attention.

Cassava is widely cultivated in Kerala's hilly regions, making the state the second-largest producer in India. For smallholder farmers, cassava serves as a key crop for both household consumption and local markets. Traditional harvesting involves bending down and uprooting the tubers by hand. This practice is extremely labour-intensive, causes strain to the back and knees, and loosens the soil, thereby increasing erosion risks. The burden falls disproportionately on women, who also carry the responsibility for weeding, another repetitive and physically demanding activity. Because of the difficulties involved, farmers often cut weeds at the stem, which only delays their growth rather than controlling them effectively.

Farmer innovators Jose K.V. and Jose Cheriyan developed a lightweight and practical tool for uprooting cassava and weeds



The Innovation

In response to these challenges, two brothers, Jose K.V. and Jose Cheriyan from Thodupuzha in Idukki District, developed a lightweight and practical tool for uprooting cassava and weeds. The design is based on a simple principle: the stem of the plant is clamped between the jaws of the tool, and by gently tilting the handle backward, the plant is uprooted without requiring the farmer to bend forward. This small adjustment in technique transforms the harvesting process, as it significantly reduces the physical effort needed and minimises soil disturbance.

The tool is sturdy yet easy to handle, and can be used by men, women and even children. It has been refined through several iterations, resulting in two specialised models: one designed for cassava harvesting and another for weed removal. Farmers who have adopted the tool report that it enables them to harvest two cassava plants or four deep-rooted weeds per minute, making the work faster, safer and less exhausting.

Adoption and Impact

The innovators established a small business to produce and distribute the tool. To date, more than 2,000 units have been sold. Feedback from farmers highlights multiple benefits: the reduction of physical strain and back pain, improved soil conservation due to minimal disturbance, and the prevention of damage to cassava tubers during uprooting. The tool has also been adapted beyond cassava fields, with medicinal plant farmers finding it particularly effective for harvesting *Kurunthotti* (*Sida cordifolia*), a perennial shrub. With the support of Kerala Startup Mission and UNDP Green Innovation Fund, Creativiti Council a non profit start up promoted the product among marginal farmers and NGOs.

Based on farmers' experiences, the innovators have continued to improve the design. When users reported that the arch of the tool got bent in hard soils or when uprooting unusually large roots, the innovators reinforced the arch. Similarly, when the movable jaw occasionally broke in wet and soggy conditions, it was strengthened. Such ongoing improvements illustrate the dynamic process of farmer-led innovation, where feedback from the field continually shapes the refinement of technology.

Prolinnova's Role

The Prolinnova network (PROmoting Local INNOVATION in ecological agriculture and NRM),



The women friendly harvesting tool

a global community of practice that recognises and promotes farmer innovation, has been instrumental in sharing this technology with a wider audience. In April 2024, the cassava-harvesting tool was featured at the Farmer Innovation Fair (FIF) hosted by Prolinnova–Kenya in Nairobi. Through short video presentations, Asian grassroots innovations were introduced to African farmer innovators and Agricultural Research and Development (ARD) partners, sparking great interest in cross-regional exchange.

Building on this momentum, Prolinnova in association with its host organization Peermade Development Society will organise its bi-annual International Partners Workshop (IPW) in Kerala in November 2025. This workshop will bring together partners from across Africa and Asia to exchange experiences and learn from each other. The programme will include exhibitions of farmer innovations, interactive sessions for knowledge-sharing, and field visits. Participants will have the opportunity to meet the innovators of the cassava-harvesting tool, visit their farms, and engage directly in discussions on local innovation and farmer-led experimentation.

Conclusion

The cassava-harvesting tool from Kerala is a striking example of how grassroots ingenuity can generate eco-friendly technologies that address both social and environmental challenges. By reducing drudgery, preventing soil erosion and safeguarding farmers' health, the tool represents a step toward more sustainable

smallholder agriculture. Its success also demonstrates the value of platforms like Prolinnova, which foster collaboration, facilitate cross-cultural exchange, and amplify farmer-led innovations. Such efforts ensure that locally developed solutions not only improve livelihoods in their immediate context but also inspire adaptation and replication worldwide.

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Performance evaluation of farmer invented semi – manual Cassava Harvester

Cassava is a staple food crop of Kerala. Cassava is one of the major and most widely cultivated tuber crops in Thiruvananthapuram District, which covers an area of 12,504 ha (Farm Guide, 2020), accounting for 20.14% of Kerala's total cultivated area. The major nutrient component of cassava tubers is starch, which constitutes up to about 40% of their composition. The weight of tubers may vary from 3.5 to 6.0 kg under favourable conditions. The number of roots per plant ranges from 2 to 8, with an average length of 250–650 mm and a diameter of 30–60 mm at the time of harvest.

Manual uprooting of cassava using bare hands, with or without the aid of indigenous tools such as a hoe, is commonly practised. However, this method is labor-intensive, time-consuming, and often results in high tuber breakage during harvest. Depending on the soil type, the effort required for uprooting increases, which in turn reduces the area harvested per day. Consequently, the profitability of farmers declines due to high labour costs. To address this problem, the semi-manual cassava harvester developed by Jose K. V. and Jose Cheriyan in 2019, operates on the lever principle, thereby reducing drudgery and improving harvesting efficiency.

The cassava harvester operates on the third-order lever principle. The weight of the equipment is 3.5 kg, and it is constructed using 8 mm spring steel, ensuring both strength and flexibility. The major components of the implement include a handle, fulcrum, and flexible jaw. The cost of the equipment is approximately Rs. 2,500.

Using the cassava harvester, 50–60 cassava plants can be harvested per hour, compared to only 12–15 plants using the conventional manual method. The main advantages of this small-scale mechanization are significant drudgery reduction and approximately 75% labour savings.

Parameters	Semi –manual cassava harvester	Manual Method
Tuber breakage (%)	12.50	41.70
Field Capacity (Nos./hr)	50 - 60	12 - 14
Labour requirement, (man –hr/ha)	46	205
Cost of operation (Rs/ha)	34500	153750
Labour savings (%)	77.56	-
Effort	Less	More

The low cost and simple operating mechanism of the equipment have made it highly popular among farmers in Thiruvananthapuram District.

The following technical parameters were recorded during field demonstrations conducted in various panchayats of Thiruvananthapuram District:



Conclusion

Based on the feedback received from farmers, the semi-manual cassava harvester was found to be highly effective and user-friendly. The major conclusions drawn are as follows:

1. The equipment is easy to handle, enabling even small and marginal farmers to operate it without prior technical training.
2. It requires less physical effort during operation, thereby reducing fatigue and drudgery commonly experienced in manual cassava harvesting.
3. The design of the flexible jaw allows the operator to easily fix the stem between the jaws, ensuring a firm grip and smooth uprooting action.
4. The implement causes minimal tuber breakage, helping to retain the quality and market value of the harvested cassava.
5. It offers high field capacity, allowing farmers to harvest more area within a shorter time compared to traditional methods.
6. The tool is simple in design, light in weight, and has an easy-to-operate mechanism, making it suitable for all categories of users, including women farmers.
7. With a low purchase cost, the equipment is economically viable and affordable, particularly for small and marginal farmers, promoting wider adoption at the field level.

This innovation exemplifies the success of farmer-led technological interventions in reducing drudgery, enhancing operational efficiency, and improving profitability in tuber crop cultivation.

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